REMARKS

Claims 60, 73, 87 and 99 have been amended. Claims 60-83, 85-87, 89, 90 and 94-99 are pending in the application. Claims 84, 88 and 91-93 have been cancelled. Applicant reserves the right to pursue the original claims and other claims in this application and in other applications.

Claims 60-72 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Fan et al. (U.S. Patent 6,171,883) ("Fan") in view of Akio (U.S. Patent 5,691,548) ("Akio"), Osawa et al. (U.S. Patent 6,071,443) ("Osawa") and Fossum (U.S. Patent 5,887,049) ("Fossum"). This rejection is respectfully traversed.

Fan relates to a method for forming an image array. Fan uses a spacer layer 22 in contact with a color filter layer 20 to separate "a series of patterned microlens 24a, 24b, 24c and 24d from the blanket color filter layer 20." (Col. 6, lines 44-51; Figure 1). The color filter layer 20 (Figure 1) is formed upon the blanket planarizing layer 18 which, in turn, is formed on the blanket passivation layer 16. (Col. 6, lines 4-7). Fan also teaches an encapsulant layer 25 that "conformally encapsulates exposed surfaces of the series of patterned microlens layers 24a, 24b, 24c and 24d and the blanket spacer layer 22." (Col. 8, lines 56-64). According to Fan, the encapsulant layer "may be formed of inorganic encapsulant materials, organic encapsulant materials and composite encapsulant materials why may be formed employing chemical vapor deposition (CVD) methods, plasma enhanced chemical vapor deposition (PECVD) methods, physical vapor deposition (PVD) methods and spin coating methods." (Col. 8, lines 50-56).

Akio relates to a solid state imaging device having a concave lens layer which "functions to bring light rays . . . to a position close to light incident vertically upon the photoelectric conversion portion 41." Akio teaches that "concave lens layer 52 is formed on the flat layer 51 to a lattice pattern." Akio further teaches that "[T]he concave lens layer 52 . . . is hot melted for conversion into a concave type micro-lens 52."

Osawa and Fossum are cited for other features.

Independent claim 60 as amended recites a "method of forming a microlens array for use in an imaging device" by *inter alia* "providing a substrate having an array of pixel sensor cells formed thereon and a protective layer over the cells" and "forming a spacer layer in contact with the protective layer." Independent claim 60 as amended also recites "forming a lens forming layer over and in contact with the spacer layer" and "forming a radiation transparent insulation layer including silicon insulator material on said microlens array."

The subject matter of claims 60-72 would not have been obvious over Fan in view of Akio, Osawa and Fossum. None of Fan, Akio, Osawa and Fossum, whether considered alone or in combination, teaches or suggests all limitations of amended independent claim 60. Fan fails to teach or suggest "forming a spacer layer in contact with the protective layer" and "forming a lens forming layer *over and in contact with* the spacer layer," as amended independent claim 60 recites (emphasis added). Fan teaches that spacer layer 22, which would arguably correspond to the spacer layer of the claimed invention, is formed on color filter layer 20 which is formed over the blanket planarizing layer 18 and blanket passivation layer 16. (Col. 6, lines 44-45; Col. 6, lines 4-7). The spacer layer of Fan is not "in contact with the protective layer," as in the claimed invention.

Fan also fails to teach or suggest an insulation layer "including silicon insulator material," as amended independent claim 60 recites. As noted in the Office Action, "Fan teaches that the encapsulant layer can be formed of inorganic or organic encapsulant materials." (Office Action at 2). This generic reference to a potential universe of materials is not, however, a teaching of the specific silicon material of the present invention.

Similarly, Akio fails to teach or suggest all limitations of amended independent claim 60. As noted in the Office Action, Akio teaches the formation of a concave lens layer 52 "by coating on a leveling layer 51 a photosensitive resin based on thermoplastic resin . . . such as . . . polystyrene" (col. 9, lines 28-33; Fig. 4A), and not the formation of a lens forming layer "over and in contact with the spacer layer," as amended

independent claim 60 recites. For at least these reasons, the Office Action fails to establish a prima facie case of obviousness and withdrawal of the rejection of claims 60-72.

Claims 73-83, 85 and 86 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Fan in view of Akio and Osawa. This rejection is respectfully traversed.

Independent claim 73 as amended recites a "method of forming a microlens array for use in an imaging device" by *inter alia* "forming a lens forming layer on an imaging device" and "treating said lens forming layer to form a plurality of microlenses." Amended independent claim 73 also recites "depositing a radiation transparent insulation layer on each microlens at a temperature within the range of approximately 200° to 400° C, wherein the radiation transparent layer includes a silicon insulator material."

The subject matter of claims 73-83, 85 and 86 would not have been obvious over Fan in view of Akio and Osawa. Fan, Akio and Osawa, whether considered alone or in combination, fail to teach or suggest all limitations of amended independent claim 73. Fan fails to teach or suggest "depositing a radiation transparent insulation layer on each microlens at a temperature within the range of approximately 200° to 400° C, wherein the radiation transparent layer includes silicon insulator material," as amended independent claim 73 recites. Fan teaches that the encapsulant layer can be formed by chemical vapor deposition methods, but Fan does not teach or suggest the low temperature range of the claimed invention. Fan's reference to methods of forming the encapsulating layer, such as chemical vapor deposition, plasma enhanced chemical vapor deposition, physical vapor deposition and spin coating, is not a teaching of a specific deposition method "at a temperature within the range of approximately 200° to 400° C," much less the teaching of forming a radiation transparent layer including silicon insulator material by a low temperature process. *See* M.P.E.P. § 2144.08.

Similarly, Akio teaches that concave lens forming layer 52 is formed by a spin-coating process, and not by "depositing a radiation transparent insulation layer on each microlens at a temperature within the range of approximately 200° to 400° C, wherein the radiation transparent layer includes silicon insulator material," as amended

independent claim 73 recites. Osawa relates to a "highly flexible urethane acrylate as the ionizing radiation curable resin selected from urethane acrylate" (col. 6, lines 41-53), which undergoes uniform lamination and subsequent curing, and not to "depositing a radiation transparent insulation layer on each microlens at a temperature within the range of approximately 200° to 400° C," much less to "depositing a radiation transparent insulation layer on each microlens at a temperature within the range of approximately 200° to 400° C, wherein the radiation transparent layer includes silicon insulator material," as amended independent claim 73 recites. For at least these reasons, the Office Action fails to establish a *prima facie* case of obviousness and withdrawal of the rejection of claims 73-83, 85 and 86 is respectfully requested.

Claims 87, 89-90 and 94-98 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Fan in view of Akio and Fossum. This rejection is respectfully traversed.

Independent claim 87 as amended recites a "method of forming a microlens array for use in an imaging device" by *inter alia* "forming a lens forming layer of radiation curable resin on an imaging device" and "patterning said lens forming layer to form a plurality of lens forming regions." Amended independent claim 87 also recites "treating said plurality of lens forming regions with a radiation exposure step to form a plurality of microlenses" and "forming a transparent insulation layer including silicon insulator material on the plurality of microlenses."

The subject matter of claims 87, 89-90 and 94-98 would not have been obvious over Fan in view of Akio and Fossum. None of Fan, Akio and Fossom, considered alone or in combination, teaches or suggests all limitations of amended independent claim 87. Fan fails to teach or suggest "forming a lens forming layer of radiation curable resin on an imaging device," much less "treating said plurality of lens forming regions with a radiation exposure step to form a plurality of microlenses," as amended independent claim 87 recites. Fan teaches that "the series of patterned microlens layers 24a, 24b, and 24d is formed of a patterned photoresist material . . . which . . . is thermally reflowed to form the series of patterned microlens layers 24a, 24b, 24c and 24d of convex shape" (col. 7, lines 2-

7), and not treated by "radiation exposure," as in the claimed invention. Akio teaches that concave lens layer 52 is formed "by coating on a leveling layer 51 a photosensitive resin based on thermoplastic resin . . . such as . . . polystyrene" (col. 9, lines 28-33; Fig. 4A), and not by treating a plurality of lens forming regions "with a radiation exposure step to form a plurality of microlenses," as amended independent claim 87 recites. Fossum also fails to teach or suggest all limitations of amended independent claim 87. For at least these reasons, the Office Action fails to establish a prima facie case of obviousness and withdrawal of the rejection of claims 87, 89-90 and 94-98 is respectfully requested.

Claim 99 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Fan in view of Akio. This rejection is respectfully traversed.

Independent claim 99 as amended recites a "method of forming a microlens array for use in an imaging device" by *inter alia* "forming a lens forming layer on an imaging device, wherein the lens forming layer is a layer of material selected from the group consisting of optical thermoplastic, polyimide, and thermoset resin." Amended independent claim 99 also recites "patterning said lens forming layer to form a plurality of lens forming regions." Amended independent claim 99 further recites "heat treating said plurality of lens forming regions to form a plurality of microlenses" and "depositing a transparent insulation layer including silicon insulator material on the plurality of microlenses at a temperature within the range of approximately 200° to 400° C."

The subject matter of claim 99 would not have been obvious over Fan in view of Akio. Fan and Akio, considered alone or in combination, fail to teach or suggest all limitations of amended independent claim 99. Fan and Akio do not teach or suggest "depositing a transparent insulation layer including silicon insulator material on the plurality of microlenses at a temperature within the range of approximately 200° to 400°C," as amended independent claim 99 recites.

A marked-up version of the changes made to the claims by the current amendment is attached. The attached page is captioned "**Version with markings to show changes made.**"

Allowance of the application with claims 60-83, 85-87, 89, 90 and 94-99 is solicited.

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

60. (Amended) A method of forming a microlens array for use in an imaging device, said method comprising the steps of:

providing a substrate having an array of pixel sensor cells formed thereon and a protective layer over the cells;

forming a spacer layer in contact with the protective layer;

forming a lens forming layer [on at least a portion of the protective layer] over and in contact with the spacer layer;

forming a microlens array from said lens forming layer; and

forming [an] a radiation transparent insulation layer including silicon insulator material on said microlens array.

73. (Amended) A method of forming a microlens array for use in an imaging device, said method comprising the steps of:

forming a lens forming layer on an imaging device;

treating said lens forming layer to form a plurality of microlenses; and

[forming] depositing a radiation transparent insulation layer on each microlens at a temperature within the range of approximately 200° to 400° C, wherein the radiation transparent layer includes a silicon insulator material.

87. (Amended) A method of forming a microlens array for use in an imaging device, said method comprising the steps of:

forming a lens forming layer of radiation curable resin on an imaging device;

patterning said lens forming layer to form a plurality of lens forming regions;

treating said plurality of lens forming regions with a radiation exposure step to form a plurality of microlenses; and

forming a transparent insulation layer including silicon insulator material on the plurality of microlenses.

99. (Amended) A method of forming a microlens array for use in an imaging device, said method comprising the steps of:

forming a lens forming layer on an imaging device, wherein the lens forming layer is a layer of material selected from the group consisting of optical thermoplastic, polyimide, and thermoset resin;

patterning said lens forming layer to form a plurality of lens forming regions;

heat treating said plurality of lens forming regions to form a plurality of microlenses; and

depositing a transparent insulation layer including silicon insulator material on the plurality of microlenses at a temperature within the range of approximately 200 to 400 degrees Celsius.